PROJECT SYSTEM ANALYSIS FOR PLANNING RURAL WATER SUPPLY OF 31 KECAMATANS IN WEST JAVA.

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Dalam bulan Januari dan Pebruari 1973 dengan kerjasama antara Wold Health Organisation dan Departemen Kesehatan telah diadakan pemakaian Project System Analysis (P.S.A.) untuk perencanaan air minum pedesaan di 31 kecamatan Jawa Barat. Daerah yang dipilih adalah daerah kritis. Yang dimaksud dengan daerah kritis yalah daerah yang kepadatan dan kecepatan pertambahan penduduknya tinggi, sukar mendapatkan air, angka penyakit cholera/gastro-enteritis tinggi dan potensi pengembangan sosial-ekonominya rendah. Penduduk dari 31 kecamatan ± 10 persen jumlah penduduk propinsi Jawa Barat yang ditahun 1988 diperkirakan akan menjadi 2,5 juta orang yang penghasilannya relatif rendah.

System analysis memakai pendekatan macro planning dimana 31 kecamatan diberikan urutan prioritas berdasarkan besarnya masalah dengan mengingat faktor demografi, socio-ekonomi, tehnologi air, kesehatan dan bantuan masyarakat. Lebih lanjut diadakan analisa terperinci mengenai tehnologi dan kegiatan penyediaan air minum. Demikian pula diadakan analisa mengenai tenaga kerja, bahan dan biaya yang diperlukan untuk menjalankan kegiatan tersebut di atas serta diadadakan analisa hambatan. Dalam perencanaan ini ditentukan sasaran program sebanyak ± 6.500 sistim yang terdiri dari mata air, sumur artesis dan penggunaan air permukaan dengan atau tanpa pengolahan dan pembagian. Sistim penyediaan air ini diharapkan dapat menghasilkan 150.000 M^3 air minum per hari (1736 l/det) untuk dibagikan di 7 kabupaten. Untuk penyelenggaraan dan pemeliharaan sistim yang sedemikian besar diperlukan organisasi yang mantap. Beberapa alternatif organisasi disarankan dalam P.S.A. ini.

Seluruh program ditaksir akan memakan biaya pembangunan Rp. 4,3 milyard atau Rp. 1.750,– per orang. Selanjutnya tiap tahun harus dibayar Rp. 80,– per capita oleh masyarakat dibantu pemerintah untuk biaya pelayanan.

In the past planning of rural water supply in Indonesia was not based on hard base line data and system approach Most of the water supply schemes in the past were scattered thinly all over Indonesia giving no or very little impact on the improvement of community health.

The existing schemes were not operated and maintained properly since there is no institutional arrangement for these.

An attempt was made to use Project System Analysis which was proven to be very helpful in family planning and health service development program in planning of rural water supply.

Benefits and justifications of the proposed program are : an estimated 42 per cent reduction in cholera incidence and case fatality during the cyclical peak expected, in the early 1980's; a 30 per cent reduction of other enteric conditions, amounting to some 1,5 million cases avoided during the decade 1980 – 90; an expected extension of productive life corresponding to over half a year (from birth); a 30 per cent reduction in physical and mental development hindrances now affecting the youngest age-groups.

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Based on these estimated health benefits the effectiveness cost ratio of the proposed programme would appear between 4 and 6 times higher than that of efficient programmes of disease control, e.g. tuberculosis control. The effectiveness of the rural water supply programme would considerably enhanced, however, if waste water disposal and a latrine construction programme were simultaneously implemented. The programmes also presume availability of a minimum quantity of safe water. While the value of the water per se is difficult to estimate its contribution to promoting a higher quality of life cannot be overlooked, and through this process, attitudes and abilities conducive to higher productivity can be expected.

DESCRIPTION OF AREA.

The 31 kecamatan were considered to be critical areas of the province in terms of : population density, population growth trend, water supply conditions, hydrological information, community demand and local support for maintenance of water supply schemes, health conditions and socio-economic development potential. The 31 kecamatans are located in 7 kabupatens (Fig 1):

Kabupaten Cirebon, kecamatan Arjawinangun, Gegesik, Losari, Kapetakan, Waru, Babakan.

Kabupaten Serang, kecamatan Tirtayasa, Pontang, Ciruwas, Kasemen.

Kabupaten Tanggerang, kecamatan Kresek, Kronjo, Sepatan, Mauk, Batuceper.

Kabupaten Indramayu, kecamatan. Jatibarang, Losarang, Lohbener, Lelea, Cikedung.

Kabupaten Tasikmalaya, kecamatan. Indihiang, Ciawi, Kawalu, Singaparna.

Kabupaten Cianjur, kecamatan. Cidaun, Sindangbarang, Cibeber, Warungkondang.

Kabupaten Karawang, kecamatan Cilamaya, Rengas Dengklok, Pedes.

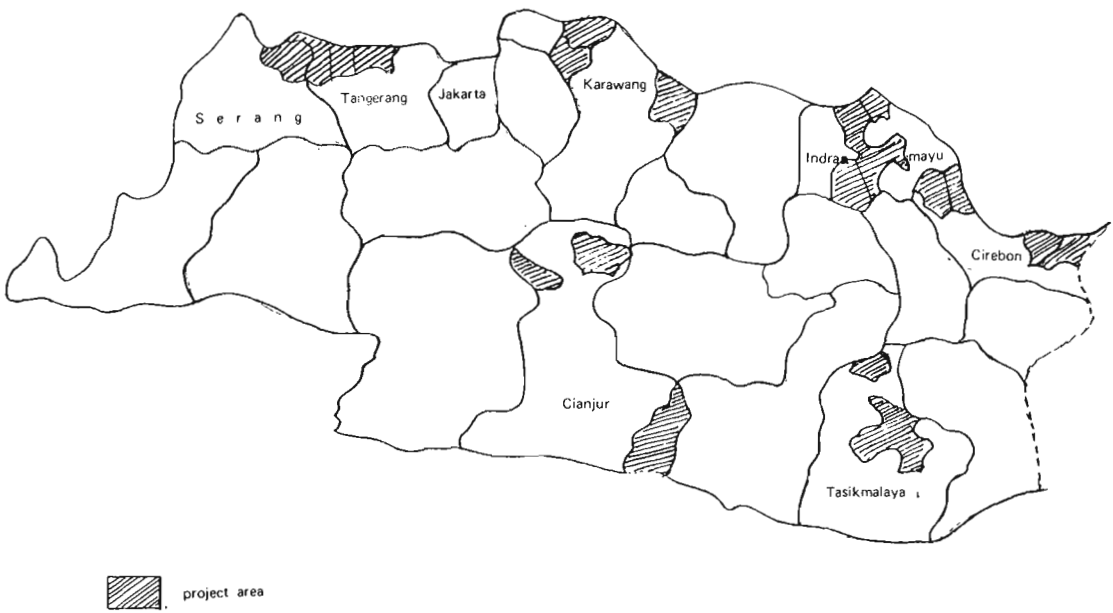

Fig.1 Map of west Java province showing location of Kecamatans which are considered as the critical areas.

Population projection in 31 selected kecamatans is presented in table 1.

Table 1 Population projection in 31 selected kecamatans

Kabupaten	Assumed growth rate	1971 (known)	Population Projection			
			1973	1978	1983	1988
Karawang	1 0188	297,499	308,789	338,927	371,941	408,243
Indramayu	1 0158	225,983	233,168	252,191	280,753	294,993
Tasikmalaya	1,0259	268,694	282,790	321,359	365,182	409,992
Cianjur	1,0203	246,790	256,920	284,066	314,094	347,296
Total	–	1,827,137	1,900,871	2,101,211	2,378,742	2,565,015

EXISTING WATER SYSTEMS.

The proportion of the population having access to water of acceptable quality was estimated during the survey as follows : (not all desas were surveyed).

Population	Pop with access		Springs		Wells w/pumps		Artesian wells	
	No	%	No	pop served	No.	pop. served	No.	pop. served
1,209,968	149,951	12,4	282	14,200	775	71,251	129	64,500

The table below provides the number and type of water systems in the project area.

Springs	Wells w/o pump	Wells with pump	Artesian well	Rain water catchment
604	50,416	1154	214	582

MATERIALS AND METHODS

The project formulation activities were:

1.0. Boundary Setting: The need for establishing formulation boundaries; possible points for inclusion in term of reference; means for supplementing.

2.0. Situation Analysis: The process of assimilation and initial analysis of raw data and processed information in the six categories required for sound project formulation:

2.1. Population
2.2. Disease and service statistics
2.3. Policies and programmes
2.4. Socio-economic conditions
2.5. Health resources
2.6. Current health technology

3.0. Problem Projection : Integration of pro-

blem determinants; projection of health problems.

4.0 Objective Setting: Dimension of concern, impact objectives.

5.0 Constraint Analysis: Population/service model, dysfunctions, constraints, initial design change specifications.

6.0 System Design: Destription of technical strategies; other design changes, alternative system configurations and the choice of one, specifying operational outputs, other system specifics.

7.0 Project Design: Activity design, costing, scheduling, organization.

8.0 Proposal Writing: Statements of finalized impact objectives and intermediate objectives, benefits and justifications, external assistance requirements, the proposal format and content (no project report, warranted).

These could be illustrated as a system in the following figure II:

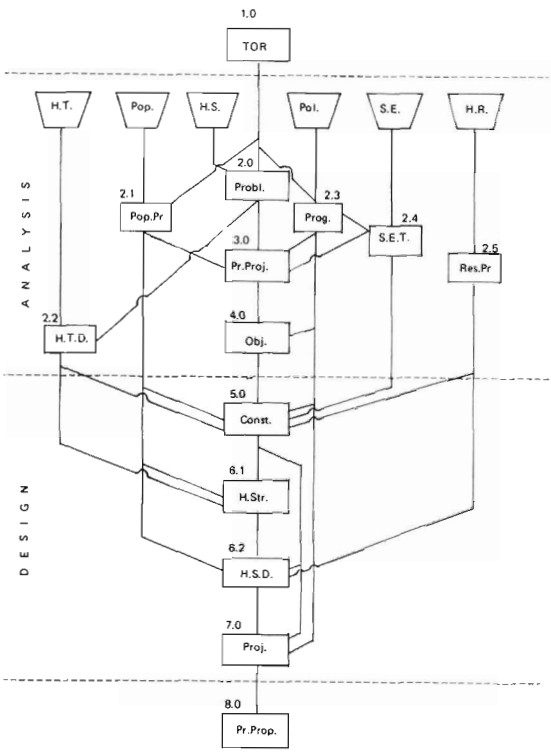

Fig. II Diagram of the project formulation activities.

ToR	=	Terms of Reference
H.T.	=	Health Technology
Pop.	=	Population
H.S.	=	Health Statistics
Pol.	=	Policy
S.E.	=	Sosio-Economic
H.R.	=	Health Resources
Probl.	=	Problem
Pr.Proj.	=	Problem Projection
Obj.	=	Objective Setting
Const.	=	Constraint Analysis
H.Str.	=	Health Strategies
H.S.D.	=	Health System Design
Proj.	=	Project Design
Pr.Prop.	=	Project Proposal
Pop.Pr.	=	Population Projection
Prog.	=	Programmes
S.E.C.	=	Socio-Economic conditions
Res.Pr.	=	Resources Projection
H.T.D.	=	Health Technology design.

The team which consists of WHO experts and staffs from the Ministry of Health (Central as well as local) were broken down into sub-teams on : population, health, resources (man, money, material) technology of water supply. The activities of sub-teams population, health and resources were mostly carried out in Bandung (Bappeda, Provincial Health Service and other Provincial Services) and Jakarta (Ministry of Health, Central Bureau of Statistics). These activities were mainly interviews and collection of existing data.

While the activities of sub-team "Technology of water Supply" were carried out in the 31 kecamatans selected. Field surveys to collect data on the existing water resources which can be developed were conducted with the assistance from the ITB (Institute Technology of Bandung). the Directorate of Hygiene and Sanitation, the National Institute of Health Research and Development and the local sanitarian and health controllers. Appropriate technology for water supply including the operation and maintenance considerations were also discussed by this sub-team with the assistance of 4 WHO

consultants. The result of the analysis done by those 4 sub-teams were then discussed in plenary sessions. These sessions were also meant for transfer of knowlodge.

The methodology of the assignment of priorities among areas selected for an action programme in rural water supply.

First, a linear programming approach to the definition of a rural water supply problem was applied. The lack of conceptual definitions, quantifiable relationships and of data prohibited a mathematical solution.

Next, a systematic method for the integgration of hydrological, hydrogeological, technological, demographic, health and socio-economic information for the definition of a water supply problem was presented.

The quantification of most of the above discussed variables along following iterative process could help to get along way towards the maximization of population coverage with water of minimum standard.

Step 1 : Determine from a review of the water situation (i.e. hydrological, hydrogeological information) and the technology analysis, the technological alternatives for construction of new and/or rehabilitation of existing water supply systems per area.

Step 2 : Determine from a review of the manpower constraints, the probability of community contribution for maintenance of water supply systems per area.

Step 3 : Rank order (as result of steps 1 and 2) the areas on the basis of highest technological alternatives for construction and/or rehabilitation and highest probability for maintenance of water supply systems.

Step 4 : Select relevant demographic dimensions (e.g. projected population, population density) for water supply systems and indicate these demographic factors per area.

Step 5 : Rank order (as a result of step 4) the areas on the basis of the highest demographic dimensions.

Step 6 . Select relevant health dimensions (e.g. incidence, prevalence, case fatality ratio) for selected health problems which relate to water supply. Indicate per area the level of the health dimensions for the selected health problem.

Step 7 : Rank order (as a result of step 5) the areas on the basis of highest probability of health problems.

Step 8 : Determine from a review of the ongoing and planned sesio-economic development in the country, province of district under consideration the growth potential of selected sosio-economic sectors.

Step 9 : Rank order (on the basis of step 8) the areas on the basis of lowest developmental potential.

Step 10 : On the basis of the rankings provided by steps 3,5,7 and 9, the areas can next be rank ordered such that the result shows descending order : the areas with lower technological alternatives for construction and probability of maintenance of water supply systems, the areas with lower probability of population problems related to water supply, the areas with lower probability of health problems related to water supply and the areas with lower probability of socio-economic development potential.

Step 11 : From a review of the manpower and financial resources, an attempt should be made to indicate the level of existing available resources per area. In addition a number of alternative financing levels should be generated where each alternative shows the level of foreign and domestic investment for water supply project.

Step 12 : This step allows for objective setting within the range of the remaining posibilities. This range has been narrowed by step 1, the technological alternatives and step 10 which integrated demographic, health and socio-economic information for determination of priority areas.

Given the highest ranked priority areas in step 10, an objective (in terms of population coverage with water of minimum standard) can be set by selecting among the technological alternative for this area (step 3) on the basis of maximum

utilization of existing manpower and local financial resources and minimum requirement for foreign investment (step 11) Next objective can be set for the second, third, etc. highest ranked priority areas. After setting objectives for all areas on the basis of one combination of levels of foreign and domestic investment, the process could be repeated for other alternative combinations of investment levels.

RESULTS

The following Fig III illustrates all factors which should be taken into consideration in water supply programme.

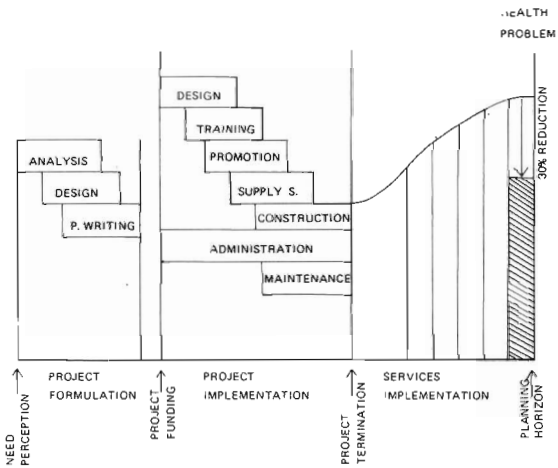

Fig. III. The diagram of all factors which should be taken into consideration in water supply programme.

The product of all the probabilities mentioned earlier gave the following priority ranking of kecamatan: Batuceper, Mauk, Losari, Singaparna, Ciawi, Ciruwas, Babakan, Kresek, Kasemen, Arjawinangun, Kapetakan, Kawaluh, Kronjo, Tirtayasa, Cibeber, Cidaun, Cilamaya, Warungkondang, Gesik, Sindangbarang, Pedes, Losarang, Indihiang, Sepatan, Rengasdengklok, Pontang, Cikedung, Jatibarang, Lohbener, Waru, and Lelea.

The analysis and design undertaken during this formulation effort produced as a primary product an estimate of the number and types of water supply schemes necessary to serve the future (1988) populations of the 31 selected kecamatans with a standard quantity (60 liters/capita/day) of safe water

The overal five year programme may be summarized as follows : 5,000 dug wells with hand pumps, 480 protected springs without distribution systems, 320 protected springs with ground reservoirs and distribution systems, 1 elevated spring with transmission and distribution system, 400 artesian wells with distribution systems 100 artesian wells with pump, elevated storage and distribution systems, and 30 surface water treatment facilities.

Table 2 Total manpower requirements by category.

Manpower	In man/years Development Gov	Con.	Maintenance Gov.	Con.
Engineers	4.0	8.2	4	
Health Controllers	8.2	–	1 3	
Sanitarians	31.2	–	3.1	
Assistant San	41.2	–	19.8	
Highly Skilled Technicians	4.0	88.2	10.1	
Skilled Labourers		196.0	122.1	(122.1
Unskilled Labourers		746.3		38.

* If treatment plant operators are contracted.

Summaries of the additional manpower by staff type felt necessary for the pursuance of this programme (development and maintenance), is in the following.

Table 3 Summary of the additional manpower requirements by staff.

	Total	Central	Pro	7 kab/31 kec
Engineers	*5*	*2*	*3*	*0*
Health controllers	11	1	3	4
Ass Sanitarians	29	0	3	26
Skilled & Semi-skilled lab.	257	0	2	255
(Treatment plant Operators could be provided throngh contractors)	135			133
	–122	0	0	–122

Maintenance cost were also calculated according to the activity costing process. A summary of resources required after programme implementation .

Man-years/year	196	181.3 million rupiahs
material		23.5 million rupiahs
	Total	204.8 million rupiahs

This indicates that salaries and incentive for maintenance activiy 89 per cent of the total cost, or 71 of the 80 rupiahs/capita. It should be noted that 122 of the 196 man-years are required for maintenance and operation of the 30 surface water treatment schemes, which could be contracted.

Table 4 Estimated cost of rural water supply project by year.

Year	Phase	Items	Cost	Total per year
1st		Design for phase I	15,320,000	15,320,000
2nd	I	Construction phase I	750,701,000	
		Design phase II	23,834,000	774,535,000
3rd	II	Construction phase II	1,167,875,000	
		Design phase III	14,427,000	1,192,302,000
4th	III	Construction phase III	1,196,922,000	
		Design phase IV	13,003,000	1,209,925,000
5th	IV	Construction phase IV	637,132,000	655,965,000
		Design phase V	18,833,000	
6th	V	Construction phase V	451,992,000	451,992,000
Total			Rp.	4,300 039 000

DISCUSSION.

The time provided for this study (2 months) was too short for such a comprehensive study However, the team had submitted a proposal which then had been followed up by :

Setting up standard design for a number of rural water supply schemes (1973/1974); Engineering survey and design for 9 kecamatans which were selected as priority areas for the first phase.

This P.S.A. for rural water supply in West Java had attracted a number of foreign agencies to assist in the design and construction, among others the Dutch Government which is now involved in this.

Some limitations encountered in the 2 month PSA study were :

This was such an intensive planning activities involving full-time core personnels which will not be practicable for further application due to limited number of staff at the Bureau of Planning. This could be done in a much longer period, many assumptions have been made which were subject to individual judgements, Estimates on the material and manpower needs were not based on hard data (only based on priliminary surveys) thus subject to many errors, the time schedules stated in the proposal apparently could not be followed due to budget and policy limitations, thereby it is not stated in this presentation, and the implementation of this program has not been very smooth due to limited budget which can not be allocated to these 7 kabupatens only.

However this PSA study has been the best

way of planning rural water supply which should be applied in other localities to obtain a comprehensive planning based on system approach.

SUMARRY.

In order to get better planning methodology for rural water supply a Project System Analysis was tried out to formulate proposal for rural water supply for 31 kecamatans in West Java. This was also meant for the transfer of knowlodge on PSA from a WHO expert team to the staff of Ministry of Health who are involved in the planning of rural water supply in Indonesia.

The study was conducted for two months (January, February 1975) and a proposal has been submitted for approval and follow up.

Priority was set up for the selected 31 kecamatans and the implementation of the proposal was divided into 5 phases which should actually be started 1973/1974 and will be completed in 1979.

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